Check List the journal of biodiversity data

NOTES ON GEOGRAPHIC DISTRIBUTION

Check List 15 (4): 555–563
https://doi.org/10.15560/15.4.555

PENSOFT

First country record of *Rhinobothryum bovallii* (Andersson, 1916) (Squamata, Colubridae) from Nicaragua

José Gabriel Martínez-Fonseca[1,2,3], Julio Loza[1,3], Maynor Fernández[1,3], Milton Salazar-Saavedra[3,4,5], Javier Sunyer[3,4]

1 Universidad Nacional Autónoma de Nicaragua (UNAN), Enel Central 2.5 km S, Villa Fontana, Managua, Nicaragua. **2** School of Forestry, Northern Arizona University, 200 E Pine Knoll Dr, Flagstaff, AZ 86011, USA. **3** Grupo HerpetoNica (Herpetólogos de Nicaragua), Nicaragua. **4** Museo Herpetológico de la UNAN-León (MHUL), Universidad Nacional Autónoma de Nicaragua-León (UNAN-León), Empalme de la carretera León-Poneloya con Abangasca, 1 km al este, en el Jardín botánico ambiental de la UNAN-León, León, Nicaragua. **5** Red Mesoamericana y del Caribe para la conservación de Anfibios y Reptiles (Red MesoHerp), km 76.9 carretera federal libre 190 Tuxtla Gutiérrez-San Cristóbal, Chiapas, México.

Corresponding author: José Gabriel Martínez-Fonseca, jm3934@nau.edu

Abstract

We report on the first definite record of the False Tree Coral Snake, *Rhinobothryum bovallii* (Andersson, 1916), from Nicaragua based on one specimen from the Refugio Bartola, department of Río San Juan, southeastern Nicaragua. The newly found specimen narrows a 510 km distributional gap between occurrences from near the Honduran–Nicaraguan border and the nearest occurrence in Costa Rica.

Key words

Distribution; False Tree Coral Snake; Indio-Maíz; Lowland Wet Forest; Refugio Bartola; reptile; Río San Juan.

Academic editor: Sebastian Lotzkat | Received 20 February 2019 | Accepted 10 May 2019 | Published 5 July 2019

Citation: Martínez-Fonseca JG, Loza J, Fernández M, Salazar-Saavedra M, Sunyer J (2019) First country record of *Rhinobothryum bovallii* (Andersson, 1916) (Squamata, Colubridae) from Nicaragua. Check List 15 (4): 555–563. https://doi.org/10.15560/15.4.555

Introduction

The False Tree Coral Snake, *Rhinobothryum bovallii* (Andersson, 1916), is a rare, slender, and long nocturnal snake, which is characterized by the contrasting coloration on its head, where each shield on the dorsal surface has a black blotch edged with white or cream (Savage 2002, Köhler 2008). This species is known to occur on the Atlantic versant from eastern Honduras to northwestern Venezuela, and on the Pacific versant from central Panama to northwestern Ecuador, from sea level to 2,000 m elevation (Savage 2002, Solórzano 2004, Köhler 2008, Arredondo et al. 2017, Pazmiño-Otamendi 2017, Turcios-Casco et al. 2018). There is, however, no voucher specimen of this species from Nicaragua (Köhler 2001, 2008, Sunyer and Köhler 2010, McCranie 2011, Sunyer 2014, Sunyer et al. 2014, Arredondo et al. 2017, Turcios-Casco et al. 2018).

Rhinobothryum bovallii is a tricolored (red-white/yellow-black) ringed coral snake-mimic. This species mimics the sympatric *Micrurus alleni* Schmidt, 1936 and *M. nigrocinctus* (Girard, 1855) and is part of the mimetic complex of the genera *Erythrolamprus* Boie, 1826, *Oxyrhopus* Wagler, 1830, and *Pliocercus* Cope, 1860 found in the neotropics (Turcios-Casco et al. 2018, Uetz et al. 2018). This species of snake is opisthoglyphous and feeds predominantly on lizards, frogs, and small mammals. It inhabits undisturbed lowland broadleaf rainforests

Copyright *Martínez-Fonseca et al.* This is an open access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

where it is seldom seen, although it is unclear whether the snake is an inhabitant of the canopy or mostly terrestrial (Savage 2002, Solórzano 2004, Köhler 2008, McCranie 2011, McConnell 2014, Arredondo et al. 2017, Turcios-Casco et al. 2018). This species has the IUCN Red List category of Least Concern because it has a large distribution and has no major threats (Arredondo et al. 2017). Its association with undisturbed primary lowland moist and wet forests, however, might make it vulnerable to population declines in regions with ongoing forest fragmentation and deforestation (Arredondo et al. 2017).

In March 1954, J.G. Montrello collected an adult male *R. bovallii* near Arenal, 25 km E of Jalapa, Nicaragua (Campbell and Howell 1965). This specimen, LACM 20488 (formerly UCLA 14716) was erroneously given as LACM 204888 by Turcios-Casco et al. (2018). At the time of this specimen's collection, Arenal was part of the Department of Nueva Segovia, Nicaragua, but in 1961, the World Court (today the International Court of Justice) granted the area to Honduras and the correct current name for the locality is "Arenales, Municipio de Trojes, Departamento de El Paraíso, Honduras". Arenales lies 3 km from the present-day Nicaraguan border and is currently deforested (Turcios-Casco et al. 2018: 142). Many of the specimens reported from that site by Campbell and Howell (1965) were collected during logging operations along the Río Coco (which serves as the international border between Honduras and Nicaragua), and no distinction was made as to which side of the river specimens were taken. Therefore, LACM 20488 was labeled as having originated "from Nicaragua or Honduras" (Campbell and Howell 1965: 135, Turcios-Casco et al. 2018: 139).

Although LACM 20488 was the only valid record of *R. bovallii* north of Costa Rica until 2017 (see below), the species has been consistently included in checklists of the herpetofauna of Honduras, such as by Wilson and Meyer (1982, 1985), Wilson (1983), Wilson and McCranie (1994, 2002, 2004), McCranie (2009, 2011, 2015), and Solís et al. (2014). Recently, Turcios-Casco et al. (2018) provided a confirmed Honduran record of *R. bovallii* collected on 19 February 2017 from the Ciudad Blanca archaeological site ("The Lost City of the Monkey God"), which is located in the central zone of the Reserva del Hombre y la Biósfera del Río Plátano, Departamento de Gracias a Dios, in the Honduran Mosquitia.

Based on Campbell and Howell's (1965) binational record (LACM 20488), *R. bovallii* also has been included in several herpetofaunal checklists for Nicaragua, such as Villa (1983), Villa et al. (1988), Ruiz (1996), and Ruiz and Buitrago (2003), as well as the Reptile Database (Uetz et al. 2018). Köhler (2001, 2008), Sunyer and Köhler (2010), Sunyer (2014), Sunyer et al. (2014), and Arredondo et al. (2017), however, regarded this species as of probable occurrence in Nicaragua awaiting a voucher from a specific Nicaraguan locality to justify its inclusion in the country's checklist. Here, we report on the first confirmed record of *R. bovallii* from Nicaragua.

Methods

The snake was collected and photographed during an opportunistic search in the Refugio Bartola, Departamento de Río San Juan, Nicaragua. The specimen was euthanized with an intracardiac injection of chlorobutanol, fixed in 4% formaldehyde solution, and preserved in 70% ethanol. The specimen's identification was verified with the use of the dichotomous keys provided by Savage (2002) and Köhler (2008). The specimen was collected under the authorization DGB-IC-058-2017 provided by the personnel of MARENA (Ministerio de Ambiente y Recursos Naturales), Managua, Nicaragua, and was deposited at the herpetological collection of the Zoology Museum of the University of Michigan, USA, with the catalog number UMMZ 247120. Institutional acronyms for museum collections follow those of Sabaj-Perez (2016), except for UTADC, University of Texas at Arlington Digital Collection, USA. Locality records for other records of *R. bovallii* were obtained from relevant scientific literature as well as from the Global Biodiversity Information Facility webpage (http://www.gbif.org). We also included photographic records from http://www.inaturalist.org.

Results

New record. Nicaragua: Río San Juan: Reserva de la Biósfera Sureste de Nicaragua: Refugio Bartola (10.9707° N, 084.3338° W, datum WGS84; 65 m elevation), close to the mouth of the Río Bartola, near the border with the Reserva de la Biósfera Indio-Maíz, Julio Loza collector, 15 April 2018 (1 specimen, adult male, UMMZ 247120; Fig. 1).

The snake was encountered at night (2130 h), while active at ground level crossing a small trail in a forested area, which was deeply affected by the effects of Hurricane Otto in late November 2016 (Fig. 2).

Identification. UMMZ 247120 has the following characteristics: adult male, as evidenced by presence of hemipenes; compressed and slender body (total length 1,239 mm and SVL 944 mm); tail moderate (24% of total length); weight 71.4 g; dorsal pattern of tricolor complete rings arranged in monads, with each broad black ring separated from broad red rings by a narrow white or yellowish ring; body rings: 15 black, 15 red, and 31 white (or yellowish); tail patterned like dorsum; tail rings: 9 black (8 rings plus the extreme tip of tail), 8 red, and 16 white (or yellowish); most scales in red rings tipped with black; broad and very distinct head with the upper enlarged head shields black outlined by sharply contrasting pale edging; temporal area red with black spots; large eyes and nostrils; 1 preocular; two postoculars; 1 divided loreal (upper and lower); 8 supralabials, with 4th and 5th bordering orbit; 10 infralabials; temporals 2+2; dorsal scales in 21–21–17 rows (15 just anterior to cloaca), with the anterior neck scales smooth, becoming weakly keeled along the dorsum of body and eventually keeled

Figure 1. An adult male *Rhinobothryum bovallii* (UMMZ 247120, live specimen) from Refugio Bartola, Departamento de Río San Juan, Nicaragua. Inset: Hemipenis of UMMZ 247120 (Preserved). Photos: JGMF and GS.

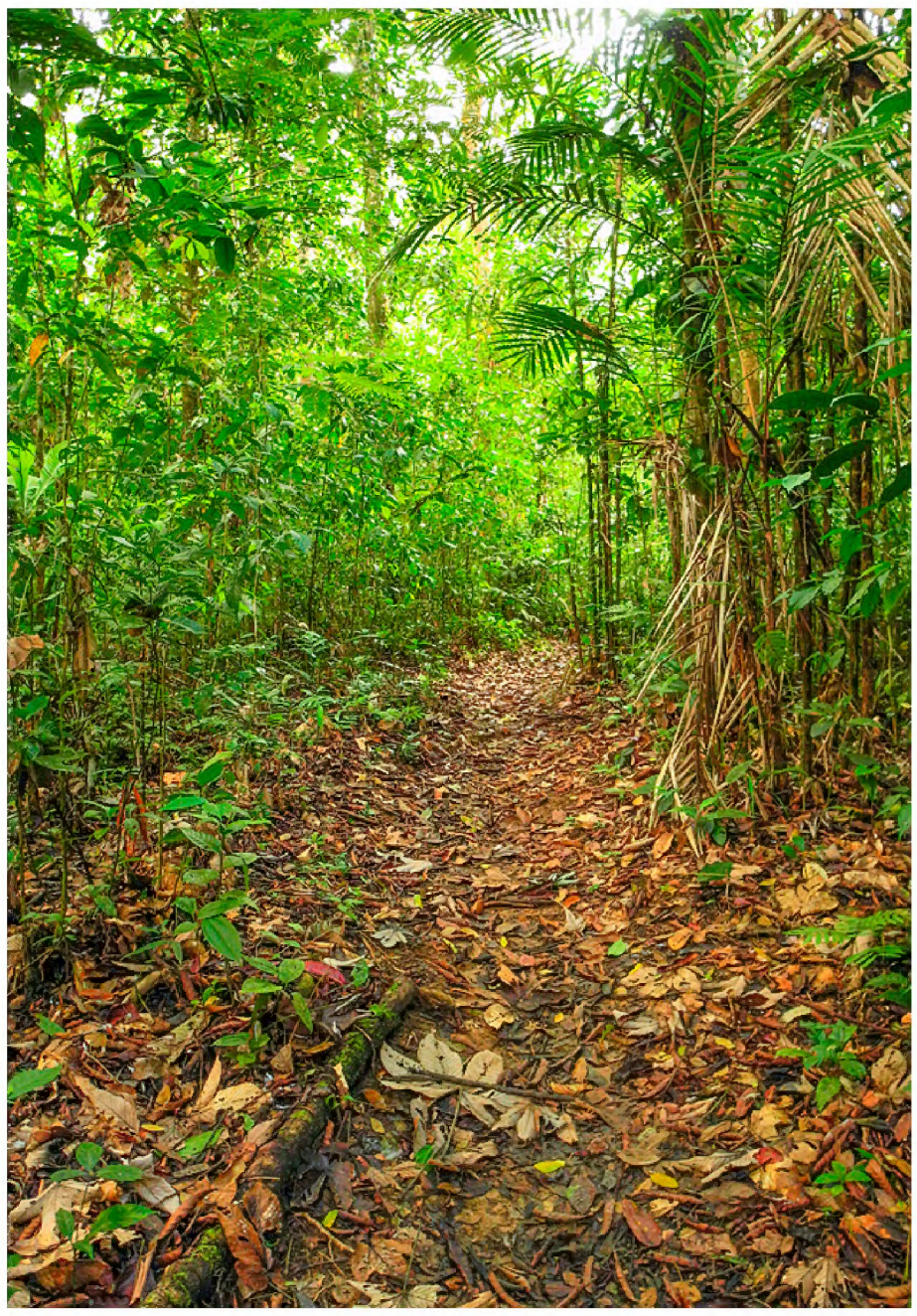

Figure 2. Habitat picture where *Rhinobothryum bovallii* (UMMZ 247120) was found at Refugio Bartola, Departamento de Río San Juan, Nicaragua. Photo: JGMF

along the posterior portion of body; scales smooth along sides of body; apical scale pits present; cloacal scute divided; 238 ventrals; and 114 paired subcaudals. These characteristics distinguish *R. bovallii* from all the other snake species in the area (Savage 2002, Köhler 2008).

The hemipenis of *R. bovallii* is, as anticipated by McCranie (2011), similar to that of its only congeneric species, *R. lentiginosum* (Scopoli, 1785), which was described by Savage (2002: 681) based on the drawing of a retracted organ in Cope (1895: pl. 30, fig. 4). The everted preserved left hemipenis of UMMZ 247120 (Fig. 1) is single, cylindrical, and has a simple sulcus spermaticus. The tip of the preserved organ reaches to the level of the sixth subcaudal. The pedicel is nude, the truncus is spinous (spines are considerably larger around the midportion of the asulcate side), and the distal third portion is covered with papillate calyces. Although the right hemipenis of UMMZ 247120 is only partially everted, both hemipenes are apparently symmetrical.

Discussion

The new record represents the first definite occurrence from Nicaragua and fills a 510 km gap in the species' distribution between the Honduran–Nicaraguan border and the closest Costa Rican occurrence (Fig. 3; Campbell and Howell 1965, Savage 2002, Köhler 2008, Turcios-Casco et al. 2018). There is, however, a Costa Rican photographic record only 35 km southeast from

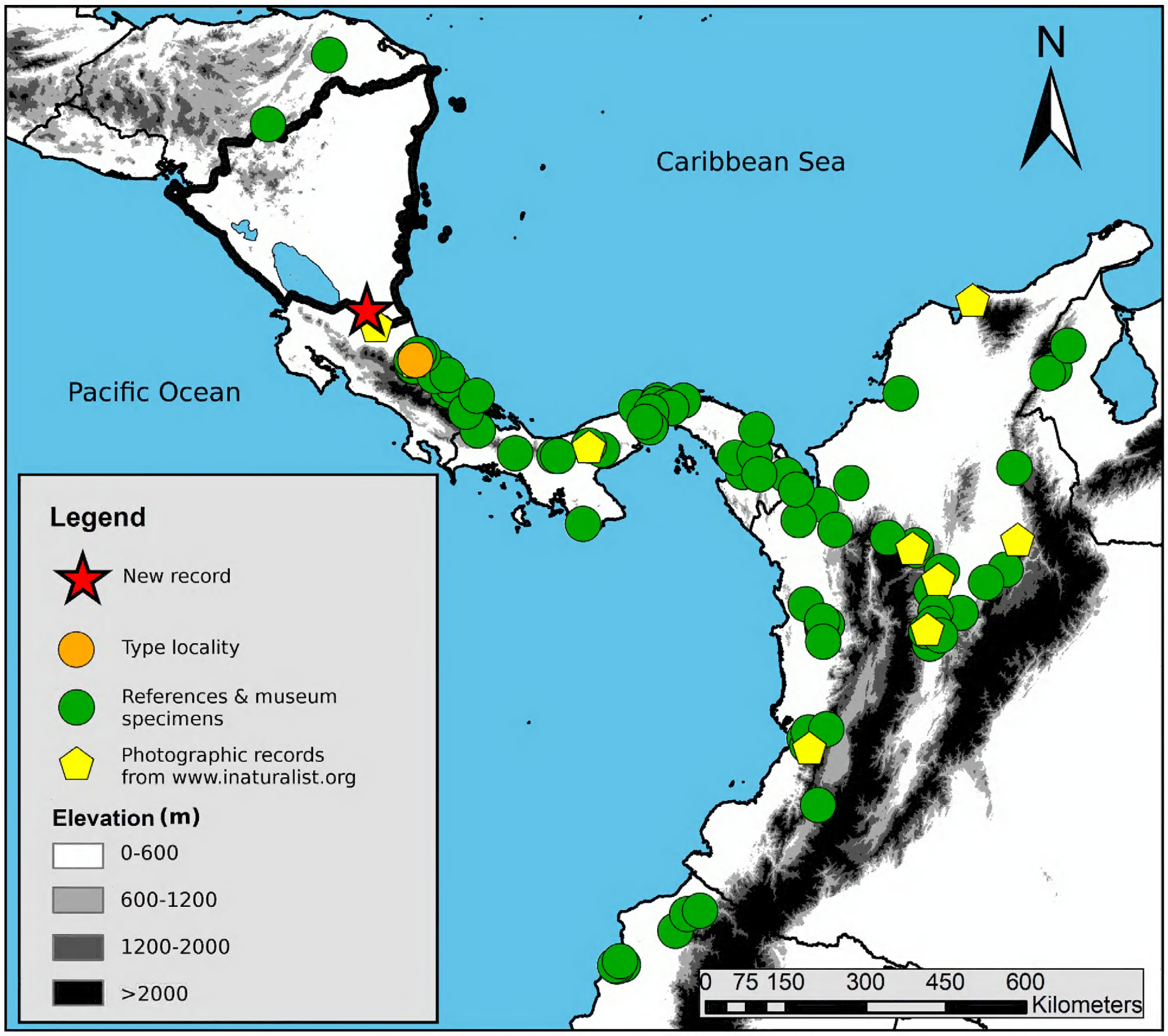

Figure 3. Distribution map of *Rhinobothryum bovallii* highlighting in bold Nicaragua.

our new record (Fig. 3; Appendix Table A1; http://www.inaturalist.org).

All morphological characters of UMMZ 247120 match with the available descriptions of *R. bovallii* with 2 exceptions (Savage 2002, Lotzkat 2014): 238 ventral scales (range of 239–246) and 114 paired subcaudals (range of 115–129). Nonetheless, we consider that these minor differences are close enough to the documented variability of *R. bovallii*. This species is very characteristic and unlikely to be confused with any other snake species in the area (Savage 2002, Köhler 2008).

Rhinobothryum bovallii is a relatively uncommon and infrequently encountered species that is poorly recorded outside its core distribution in Costa Rica, Panama, and Colombia (Fig. 3; Appendix Table A1; Savage 2002, Rojas-Morales 2012, Arredondo et al. 2017, Pazmiño-Otamendi 2017). Although *R. bovallii* has also been recorded in Guatemala by Vanzolini (1986) and Campbell and Vannini (1989), there is no supporting evidence for these records, and it is highly unlikely that it occurs there (McCranie 2011, Turcios-Casco et al. 2018). Some digital databases accessed on 5 November 2018 provided records of *R. bovallii* from Suriname (UF 56012, 61298, 71560, 27030, SBMNH HE 846, and AMNH R-119433; http://vertnet.org/), Guyana (UF 56016, 60919; http://vertnet.org/), and Amazonian Colombia (IAvH-R-6454; Borja-Acosta 2017; https://www.gbif.org/occurrence/1801437241). However, given the known distribution of *R. bovallii*, we suspect that these records correspond to misidentifications of the Amazon Banded Snake, *R. lentiginosum*, a congeneric species known to occur east of the Andean cordillera in Colombia, Ecuador, Peru, Bolivia, Venezuela, French Guiana, Guyana, and Brazil (Gomes de Arruda et al. 2015, Uetz et al. 2018).

The wide range of *R. bovallii* contributes to it having been evaluated as Least Concern in the IUCN Red List. Because this species is strictly associated with pristine rainforests, it is considered an indicator species of healthy broadleaf rainforest, but with deforestation, its subpopulations are likely to be isolated (Wilson and McCranie 2003, Arredondo et al. 2017), especially in the northern range of the species where it is known from few specimens. Our new record of *R. bovallii* (UMMZ

247120) was made in the Refugio Bartola. The general area has been classified as Lowland Wet Forest (Holdridge 1967, Savage 2002), with abundant secondary growth vegetation such as palms and bushes, and with scattered trees reaching an altitude of ca 30 m (Fig. 2). Refugio Bartola is one of the most diverse herpetofaunal localities in Nicaragua (Köhler 2001, Sunyer and Pierson 2015) and has regularly been sampled herpetofaunally over the last 20 years (1998–2018). Nevertheless, this is the first time that this snake species has been encountered here, and we suspect this opportunistic find could be a consequence of the extreme disturbance of the forest surrounding Refugio Bartola caused by Hurricane Otto in late November 2016 (Brown 2017).

Although Refugio Bartola borders the Reserva Biológica Indio-Maíz, one of Central America's largest remaining pristine broadleaf forest patches (Jordan et al. 2016), not even this vast protected area is free from habitat loss. In late March to early April 2018, Indio-Maíz suffered from intense fires, which consumed vast portions of pristine rainforest and triggered the current political crisis in the country (IACHR 2018). While a high rate of degradation during the last ~100 years has led to a loss of connectivity among Nicaraguan forest patches (Weaver et al. 2003, Jordan et al. 2016), we predict the existence of additional isolated populations of *R. bovallii* in remaining healthy forest patches in the Atlantic lowlands and premontane areas of Nicaragua.

Acknowledgements

We thank Iris Holmes and Greg Schneider from the University of Michigan for providing the voucher number, photographs, and scale counts of the specimen, as well as for depositing it in the UMMZ collection. We thank Coleman M. Sheehy III from the Florida Museum of Natural History for providing information on specimens from Suriname. We also thank Erin P. Westeen, Sebastian Lotzkat, Gunther Köhler, and Abel Bastista for reviewing the manuscript, and Sandra Castrillo and the Refugio Bartola staff for their support during this and several other field expeditions to the area.

Authors' Contributions

JL conducted the survey. MF, MSS, and JGMF took the photographs, the morphometric data, and preserved and exported the voucher. JS and JGMF wrote the text and made the table and map. All authors read and approved the final manuscript.

References

Acosta-Galvis A, Borja-Acosta K (2018) Anfibios y reptiles del municipio El Carmen de Chucurí, Santander – Proyecto Santander BIO. Version 3.1. Instituto de Investigación de Recursos Biológicos Alexander von Humboldt. https://doi.org/10.15472/rlwmxs

AMNH–American Museum of Natural History (2015) AMNH Herpetology Collections. Record ID: urn:catalog:AMNH:Herpetology:R-107943. http://ipt.vertnet.org:8080/ipt/resource.do?r=amnh_herps. Accessed on: 2015-02-19.

Asociación Nacional para la Conservación de la Naturaleza (ANCON) (2006) Evaluación ecológica rápida del Corredor Biológico Serranía el Bagre y en la zona de amortiguamiento. Plan integral de consolidación del Corredor Biológico Serranía el Bagre, Distrito de Chepigana, Provincia de Darién. Autoridad Nacional del Ambiente (ANAM), Proyecto PDd 14/00 Rev. 5F. Asociación Nacional para la Conservación de la Naturaleza (ANCON), Balboa, Panamá, 152 pp.

Andersson LG (1916) Notes on the reptiles and batrachians in the Zoological Museum at Gothenburg with an account of some new species. Göteborgs Kungliga Vetenskap och Vitter Hets-Samnalles Hndlingar Sjatte Foljden (Series B, 4) 17 (5) [= Meddelanden fran Göteborgs Musei Zoologiska Afdelning, No. 9]: 1–41.

Arredondo JC, Cisneros-Heredia DF, Rivas G, Sunyer J, Townsend JH (2017) *Rhinobothryum bovallii*. The IUCN Red List of Threatened Species 2017: e.T177498A1489023. http://doi.org/10.2305/IUCN.UK.2017-2.RLTS.T177498A1489023.en.

Borja-Acosta K (2017) Colección de Reptiles del Instituto Alexander von Humboldt. Version 23.0. Instituto de Investigación de Recursos Biológicos Alexander von Humboldt. https://doi.org/10.15472/bg0gnd

Brown DP (2017) Tropical cyclone report: Hurricane Otto. National Hurricane Center, National Oceanic and Atmospheric Administration, Miami, 28 pp.

Brown R (2018) KUBI Herpetology Collection. Version 31.18. University of Kansas Biodiversity Institute. https://doi.org/10.15468/ubdwdc

Calderon M, Lynch J, Raz L, Agudelo H (2018) Colección de Herpetología del Instituto de Ciencias Naturales (ICN-MHN-Her). Universidad Nacional de Colombia. https://doi.org/10.15468/dibp9m

Campbell HW, Howell TR (1965) Herpetological records from Nicaragua. Herpetologica 21 (2): 130–140.

Campbell JA, Vannini JP (1989) Distribution of amphibians and reptiles in Guatemala and Belize. Proceedings of the Western Foundation of Vertebrate Zoology 4: 1–21.

Carrizo Díaz AR (2010) Riqueza y Abundancia de la Herpetofauna de la Cuenca Alta del Río Santa María, Santa Fe, Veraguas. MSc dissertation, Universidad Autónoma de Chiriquí, David, Chiriquí, Panama, 110 pp.

Cope ED (1895) The classification of the Ophidia. Transactions of the American Philosophical Society 18 (2): 186–219.

Daza Rojas JM (2018) Colección de Reptiles - Museo de Herpetología de la Universidad de Antioquia. Version 3.0. Universidad de Antioquia. https://doi.org/10.15472/z6yhzr

Dickey D (2016) AMNH Herpetology Collections. American Museum of Natural History. https://doi.org/10.15468/jfkgyh

European Molecular Biology Laboratory (EMBL) (2018) Geographically tagged INSDC sequences. https://doi.org/10.15468/cndomv

Espitia Barrera JE (2018) Colección de Ofidios Museo de La Salle Bogotá (MLS). Version 4.1. Universidad de La Salle. https://doi.org/10.15472/gnumbe

Feeney R (2018) LACM Vertebrate Collection. Version 18.3. Natural History Museum of Los Angeles County. https://doi.org/10.15468/77rmwd

Flores EE, de Gracia V, Peña B (2016) *Rhinobothryum bovallii* (False Tree Coral). Geographic Distribution. Herpetological Review 47 (3): 429.

Flórez Jaramillo LA, Barona Cortés E (2016) Diversity of reptiles associated with three contrasting areas in a Tropical Dry Forest (La Dorada and Victoria, Caldas). Revista de Ciencias 20 (2): 109–123.

Fuenmayor QD (Ed.) (2011) Evaluación Ecológica Rápida Reserva Forestal de Chepigana. Proyecto PD 482/02 Rev. 2. Autoridad Nacional del Ambiente (ANAM), Balboa, Panama, 162 pp.

Gomes de Arruda LA, de Carvalho MA, Kawashita-Ribeiro RA (2015) New records of the Amazon banded snake *Rhinobothryum*

lentiginosum (Serpentes: Colubridae) from Mato Grosso state, Brazil, with natural history notes. Salamandra 51 (2): 199–205.

Hammack S, Brinker A (2008) *Rhinobothryum bovallii* (NCN). Reproduction. Herpetological Review 39 (1): 100–101.

Holdridge LR (1967) Life Zone Ecology. Revised Edition. Tropical Science Center, San José, Costa Rica, 206 pp.

Hoyos JM (2018) Colección de reptiles del Museo de Historia Natural de la Pontificia Universidad Javeriana. Version 5.2. Pontificia Universidad Javeriana. https://doi.org/10.15472/ihraxv

IACHR (Inter-American Commission on Human Rights) (2018) Gross human rights violations in the context of social protest in Nicaragua. Organization of American States, 94 pp. http://www.oas.org/en/iachr/reports/pdfs/Nicaragua2018-en.pdf. Accessed on: 2018-08-13.

Jordan CA, Schank C, Urquhart GR, Dans AJ (2016) Terrestrial mammal occupancy in the context of widespread forest loss and a proposed interoceanic canal in Nicaragua's decreasingly remote south Caribbean region. PLoS ONE 11 (3): e0151372. https://doi.org/10.1371/journal.pone.0151372

Köhler G (2001) Anfibios y Reptiles de Nicaragua. Herpeton, Offenbach, Germany, 208 pp.

Köhler G (2008) Reptiles of Central America. 2nd ed. Herpeton, Offenbach, Germany, 400 pp.

Leenders T (2017) Amphibians and Reptiles of Cocobolo Nature Reserve. Roger Tory Peterson Institute of Natural History, Jamestown, New York, United States, 56 pp.

Lotzkat S (2014) Diversity, taxonomy, and biogeography of the reptiles inhabiting the highlands of the Cordillera Central (Serranía de Talamanca and Serranía de Tabasará) in western Panama. PhD dissertation, Goethe-Universität, Frankfurt, 930 pp.

McConnell GJ (2014) A Field Guide to the Snakes of Costa Rica. Chimaira, Frankfurt, 233 pp.

McCranie JR (2009) Amphibians and Reptiles of Honduras. Listas Zoológicas Actualizadas UCR, Museo de Zoología Universidad de Costa Rica (UCR), San Pedro, Costa Rica. http://museo.biologia.ucr.ac.cr/Listas/Anteriores/HerpHon.htm. Accessed on: 2018-8-13.

McCranie JR (2011) The Snakes of Honduras: Systematics, Distribution, and Conservation. Society for the Study of Amphibians and Reptiles, Contributions to Herpetology, Volume 26, Ithaca, New York, United States, 714 pp.

McCranie JR (2015) A checklist of the amphibians and reptiles of Honduras, with additions, comments on taxonomy, some recent taxonomic decisions, and areas of further studies needed. Zootaxa 3931 (3): 352–386. http://doi.org/10.11646/zootaxa.3931.3.2

Moreno-Arias RA, Medina-Rangel GF, Carvajal-Cogollo JE, Castaño-Mora OV (2009) Herpetofauna de la Serranía de Perijá. In: Rangel-C (Ed.) Colombia diversidad biótica VIII: media y baja montaña de la Serranía del Perijá. Arfo Editores, Instituto de Ciencias Naturales, Universidad Nacional, Colombia, 449–470.

Morris PJ (2018) Museum of Comparative Zoology, Harvard University. Version 162.129. Museum of Comparative Zoology, Harvard University. https://doi.org/10.15468/p5rupv

Norton B (2018) NCSM Herpetology Collection. Version 26.2. North Carolina State Museum of Natural Sciences. https://doi.org/10.15468/enivwl

Orrell T, Hollowell T (2018) NMNH Extant Specimen Records. Version 1.19. National Museum of Natural History, Smithsonian Institution. https://doi.org/10.15468/hnhrg3

Parker S (2017) LSUMZ Herps Collection. Louisiana State University Museum of Natural Science. https://doi.org/10.15468/iogakq

Pazmiño-Otamendi G (2017) *Rhinobothryum bovallii*. In: Torres-Carvajal O, Pazmiño-Otamendi G, Salazar-Valenzuela D (2018) Reptiles del Ecuador. Version 2018.0. Museo de Zoología, Pontificia Universidad Católica del Ecuador. https://bioweb.bio/faunaweb/reptiliaweb/FichaEspecie/Rhinobothryum%20bovallii. Accessed on: 2018-8-13.

Peréz-Gallego CM (2018) Registros biológicos de especies de fauna vertebrada terrestre en las centrales de San Carlos y Jaguas - 2009. Version 10.2. Isagen. https://doi.org/10.15472/fgpjnl

Pons AR (1965) *Rhinobothryum bovallii* Andersson Género y Especie de ofidio nuevos para Venezuela. Kasmera 2 (1): 99–103.

Ray JM, Ruback P (2015) Updated checklists of snakes for the Provinces of Panamá and Panamá Oeste, Republic of Panama. Mesoamerican Herpetology 2 (2): 168–188.

Rengifo-Mosquera JT, Pino-Mosquera YL (2018) Colección Científica de Referencia Zoológica del Chocó- Herpetología. Version 17.1. Universidad Tecnológica del Chocó. https://doi.org/10.15472/sz41lm

Rojas-Morales JA (2012) On the geographic distribution of the false coral snake, *Rhinobothryum bovallii* (Serpentes: Dipsadidae), in Colombia – a biogeographical perspective. Salamandra 48 (4): 243–248.

Rojas-Morales JA, Escobar-Lasso S, Osorio-Ortíz A, Lozano-Ríos LA (2012) Third observation of the Chocoan blunt-headed vine snake, *Imantodes chocoensis* (Serpentes: Dipsadidae) for Colombia. Biota Colombiana 14 (2): 340–343.

Rojas-Runjaic FJM, Infante-Rivero EE (2018) Redescubrimiento de las serpientes *Rhinobothryum bovallii* (Andersson, 1916) y *Pleurodipsas perijanensis* (Alemán, 1953) en Venezuela. Memoria de la Fundación La Salle de Ciencias Naturales 76 (184): 83–92.

Ruiz GA (1996) Claves preliminares para reconocer a los reptiles de Nicaragua. CEDAPRODE, Managua, Nicaragua, 88 pp.

Ruiz GA, Buitrago F (2003) Guía Ilustrada de la Herpetofauna de Nicaragua. Proyecto Araucaria-Ministerio del Ambiente y los Recursos Naturales-Agencia Española de Cooperación Internacional, Managua, Nicaragua, 331 pp.

Sabaj-Perez MH (2016) Standard symbolic codes for institutional resource collections in herpetology and ichthyology: An Online Reference. Version 6.5. American Society of Ichthyologists and Herpetologists, Washington, DC. http://www.asih.org/standard-symbolic-codes. Accessed on: 2018-8-11.

Salinas S, Valencia Aguilar A (2018) Colección de anfibios y reptiles del Laboratorio de Herpetología de la Universidad del Valle (UV-C). Version 14.1. Universidad del Valle. https://doi.org/10.15472/4nryow

Savage JM (2002) The Amphibians and Reptiles of Costa Rica: A Herpetofauna between Two Continents, between Two Seas. The University of Chicago Press, Chicago, Illinois, 934 pp.

Solís JM, Wilson LD, Townsend JH (2014) An updated list of the amphibians and reptiles of Honduras, with comments on their nomenclature. Mesoamerican Herpetology 1 (1): 123–144.

Solórzano A (2004) Serpientes de Costa Rica: Distribución, Taxonomia e Historia Natural / Snakes of Costa Rica: Distribution, Taxonomy, and Natural History. Instituto Nacional de Biodiversidad (INBio), Santo Domingo de Heredia, Costa Rica, 791 pp.

Spencer C (2016) UTA Herpetology. Version 8.1. University of Texas-Arlington. https://doi.org/10.15468/mlehrb

Sunyer J (2014) An updated checklist of the amphibians and reptiles of Nicaragua. Mesoamerican Herpetology 1 (2): 186–202.

Sunyer J, Köhler G (2010) Conservation status of the herpetofauna of Nicaragua. In: Wilson LD, Townsend JH, Johnson JD (Eds) Conservation of Mesoamerican Amphibians and Reptiles. Eagle Mountain Publishing, Eagle Mountain, Utah, 488–509.

Sunyer J, Martínez Fonseca JG, Fernández MA, Ubeda Olivas MF, Obando LA (2014) Noteworthy snake records from Nicaragua (Reptilia: Serpentes). Check List 10 (5): 1134–1147. https://doi.org/10.15560/10.5.1134

Sunyer J, Pierson T (2015) A float through history on Nicaragua's Río San Juan. Herp Nation 17: 46–55.

Turcios-Casco MA, Galdamez JR, Salazar-Saavedra M, McCranie JR (2018) A second locality for *Rhinobothryum bovallii* Andersson (Colubridae) in Nuclear Central America, with comments on his habitat. Mesoamerican Herpetology 5 (1): 137–144.

Uetz P, Freed P, Hošek J (2018) The Reptile Database. http://www.reptile-database.org. Accessed on: 2018-8-12.

Vanzolini PE (1986) Addenda and corrigenda to part I snakes. Smithsonian Herpetological Information Service 70: 1–26.

Villa JD (1983) Nicaraguan fishes, amphibians and reptiles: checklist and bibliography. Universidad Centroamericana, Managua, Nicaragua, 55 pp. https://doi.org/10.2307/1445080

Villa JD, Wilson LD, Johnson JD (1988) Middle American herpetology, a bibliographic checklist. University of Missouri Press, Columbia, United States, 131 pp. https://doi.org/10.2307/1445525

Weaver PL, Lombardo DM, Martínez-Sánchez JC (2003) Biodiversity and Tropical Forest Conservation, Protection and Management in Nicaragua: Assessment and Recommendations. USAID, Managua, Nicaragua, 38 pp.

Wilson LD (1983) Update on the list of amphibians and reptiles known from Honduras. Herpetological Review 14 (4): 125–126.

Wilson LD, McCranie JR (1994) Second update on the list of amphibians and reptiles known from Honduras. Herpetological Review 25 (4): 146–150.

Wilson LD, McCranie JR (2002) Update on the list of reptiles known from Honduras. Herpetological Review 33 (2): 90–94.

Wilson LD, McCranie JR (2003) Herpetofaunal indicator species as measures of environmental stability in Honduras. Caribbean Journal of Science 39 (1): 50–67.

Wilson LD, McCranie JR (2004) The conservation status of the herpetofauna of Honduras. Amphibian and Reptile Conservation 3 (1): 6–33. https://doi.org/10.1514/journal.arc.0000012

Wilson LD, Meyer JR (1982) The Snakes of Honduras. Milwaukee, Public Museum, Publications in Biology and Geology, Number 6, Milwaukee, Wisconsin, 159 pp.

Wilson LD, Meyer JR (1985) The Snakes of Honduras. 2nd ed. Milwaukee Public Museum, Milwaukee, Wisconsin, 150 pp.

Appendix

Table A1. Locality records of *Rhinobothryum bovallii*. Records are ordered alphabetically by locality for each country in a latitudinal gradient. Codes for "source" of coordinates are: A) coordinates provided in reference; B) coordinates assigned by us from a given locality in reference; and C) coordinates estimated by us from a map in reference.

Country	Locality	Reference	Voucher	Geographic coordinates		
				Latitude	Longitude	Source
Honduras	El Paraíso: Trojes, near Arenales	Campbell and Howell (1965); Turcios-Casco et al. (2018); Feeney (2018). https://www.gbif.org/occurrence/657362782	LACM 20488	14.081446	−085.997958	A
	Gracias a Dios: Reserva del Hombre y la Biósfera del Río Plátano, Ciudad Blanca archaeological site	Turcios-Casco et al. (2018)	UVS-V-01080	15.245244	−084.965346	A
Nicaragua	Río San Juan: Refugio Bartola	Current contribution	UMMZ 247120	10.970686	−084.33378	A
Costa Rica	Alajuela: Laguna de Largarto	https://www.inaturalist.org/observations/2648512	Photograph	10.687	−084.1809	A
	Limón	Dickey (2016). https://www.gbif.org/occurrence/466359512; Spencer (2016). https://www.gbif.org/occurrence/609561429	AMNH R-5303; UTA 31635	09.98	−083.14	B
	Limón: 3 km NE Tres Equis between Turrialba and Siquirres	Feeney (2018). https://www.gbif.org/occurrence/657496686	LACM 154272	09.99061256	−083.5701429	A
	Limón: Guayacán	Savage (2002)	Photograph	10.04	−083.53	B
	Limón: Río Pacuare between Turrialba and Siquirres	Norton (2018). https://www.gbif.org/occurrence/1229582975	NCSM 84544	09.9987	−083.5424	A
	Limón: Siquirres	Andersson (1916); Hammack and Brinker (2008)	GNM 1221 (holotype)	10.10	−083.51	B
	Limón: Siquirres	https://www.inaturalist.org/observations/1562800	Photograph	10.090437	−083.541017	A
	Limón	Savage (2002)	Distribution map	09.60	−082.96	C
	Limón	Savage (2002)	Distribution map	09.68	−082.88	C
	Limón	Savage (2002)	Distribution map	09.84	−083.19	C
	Limón	Savage (2002)	Distribution map	09.85	−082.97	C
	Limón	Savage (2002)	Distribution map	10.10	−083.58	C
	Limón	Savage (2002)	Distribution map	10.16	−083.44	C
	Limón	Savage (2002)	Distribution map	10.17	−083.51	C
	Limón	Savage (2002)	Distribution map	10.19	−083.39	C
	Limón	Savage (2002)	Distribution map	10.21	−083.46	C
Panama	Bocas del Toro	Lotzkat (2014)	Distribution map	08.950	−082.439	A
	Bocas del Toro	Dickey (2016). https://www.gbif.org/occurrence/466359595	AMNH R-119089	09.23	−082.66	B
	Bocas del Toro	Lotzkat (2014)	Distribution map	09.46	−082.44	A
	Coclé	Dickey (2016). https://www.gbif.org/occurrence/466360301	AMNH R-71680	08.60	−080.37	B
	Coclé: La Pintada, El Harino, fuera del Parque Nacional General de División Omar Torrijos Herrera	Lotzkat (2014); EMBL (2018). https://www.gbif.org/occurrence/1944357174	MH 140358	08.66	−080.61	A
	Coclé: La Pintada	https://www.inaturalist.org/observations/1309822	Photograph	08.644611	−080.589944	A
	Colón: Boyd. Roosevelt Hwy. & Río Rito	Greg Schneider (UMMZ; pers. comm.)	UMMZ 147770	09.32	−079.79	B
	Darién: Serranía del Bagre, Reserva Forestal de Chepigana de Darién	ANCON (2006); Fuenmayor (2011)	Citation	08.22	−078.00	B
	Darién: Río Tuira at Río Mono	Brown (2018). https://www.gbif.org/occurrence/686819148	KUH 112460	08.46	−078.13	B
	Darién: Río Ucurganti, ca 7 km above mouth	Brown (2018). https://www.gbif.org/occurrence/686819149	KUH 112461	08.51	−077.80	B
	Darién: Tacarcuna	Brown (2018). https://www.gbif.org/occurrence/686781030	KUH 75749	08.17	−077.27	B
	Darién: Yavisa	Morris (2018). https://www.gbif.org/occurrence/476698805	MCZ R-37860, 38236	08.181065	−077.722875	A
	Guna Yala: Llano Carti, Burbayar	McConnell (2014)	Photograph	09.42	−079.00	B

Country	Locality	Reference	Voucher	Geographic coordinates		
				Latitude	Longitude	Source
Panama	Ngöbe-Buglé [erroneously as Chiriquí in Orrell and Hollowell (2018)]: Cerro Colorado, Escopeta Camp, ca. 23 km NNE of San Félix	Lotzkat (2014); Orrell and Hollowell (2018). https://www.gbif.org/occurrence/1322986335	USNM 297732	08.53	−081.83	B
	Ngöbe-Buglé: above El Paredón: Río Rasca	Lotzkat (2014); McConnell (2014)	SMF 91577	08.4910	−081.1694	A
	Panamá	Ray and Ruback (2015)	Distribution map	09.43	−079.43	C
	Panamá	Lotzkat (2014); Ray and Ruback (2015)	Distribution map	09.3600	−079.4400	A
	Panamá: Chilibre, Cerro Brewster, Parque Nacional Chagres	EMBL (2018). https://www.gbif.org/occurrence/1942204677	MH 140359	09.32	−079.28	A
	Panamá: Cocobolo Nature Reserve	Leenders (2017)	Citation	09.30	−079.21	B
	Panamá: Los Santos, ca. Ave María on Río Guanico	Brown (2018). https://www.gbif.org/occurrence/686814508	KUH 107839	07.33	−080.48	B
	Panamá: near Altos de María	Ray and Ruback (2015)	Distribution map	09.00	−079.55	C
	Panamá: Panama City, Canal Zone	Lotzkat (2014); Morris (2018). https://www.gbif.org/occurrence/476698287	MCZ R-45404	09.000	−079.550	A
	Panamá: Pequesi Chagres Ridge	Lotzkat (2014); Morris (2018). https://www.gbif.org/occurrence/476683103	MCZ R-50220	09.3600	−079.4400	A
	Panamá: Pequina-Esperanza ridge, 2 miles E of junction - 2 miles E of Panama	Loztkat (2014); Morris (2018). https://www.gbif.org/occurrence/476698577	MCZ R-42790	09.4160	−079.4270	A
	San Blás: Camp Sasardi	Parker (2017). https://www.gbif.org/occurrence/45800626; Brown (2018). https://www.gbif.org/occurrence/686819151; https://www.gbif.org/occurrence/686819152	LSUMZ 44995; KUH 112463–64	08.94	−077.77	B
	San Blás: Camp sumit	Brown (2018). https://www.gbif.org/occurrence/686819150	KUH 112462	09.06	−079.65	B
	Veraguas: Mariato District, Cerro Hoya National Park, near a tributary of Pavo River	Lotzkat (2014); Flores et al. (2016)	UTADC 8654	07.34569	−080.69133	A
	Veraguas: PNSF Cerro Tute	Carrizo Díaz (2010); Lotzkat (2014)	SMF 90022	08.48814	−081.10984	A
Colombia	Antioquia: Amalfi	Daza Rojas (2018). https://www.gbif.org/occurrence/1899847579	MHUA-R 14739	06.90	−075.08	B
	Antioquia: Anorí, Primavera village	Rojas-Morales (2012)	MHUA-R 14559	06.9850000	−075.0894444	A
	Antioquia: Briceño, Capitán village	Rojas-Morales (2012)	MHUA-R 14703	07.11194444	−075.5541667	A
	Antioquia: Chigorodó, near Turbo	http://portal.vertnet.org/o/usnm/amphibians-reptiles?id=http-n2t-net-ark-65665-318a34716-8ee0-46d7-9250-8b922af83a37; https://collections.nmnh.si.edu/search/herps/?ark=ark:/65665/318a347168ee046d792508b922af83a37	USNM 154026	07.67	−076.68	A
	Antioquia: Maceo, Las Brisas village	Rojas-Morales (2012)	MHUA-R 14583	06.54666667	−074.6433333	A
	Antioquia: Mutatá	Rojas-Morales (2012)	MHUA-R 14276	07.24722222	−076.4391667	A
	Antioquia: Río la Miel	Borja-Acosta (2017). https://www.gbif.org/occurrence/1801436600; Borja-Acosta (2017). https://www.gbif.org/occurrence/1801436608	IAvH-R-5880–81	05.71	−074.73	B
	Antioquia: San Carlos, El Jordán, Juanes, Casino Viejo	Peréz Gallego (2018). https://www.gbif.org/occurrence/727775388	ISAGEN:46-2978:SAN CARLOS:2009:REPTILES:0101	06.219139	−074.817139	A
	Antioquia: Puerto Berrío, Hermilda	https://www.inaturalist.org/observations/8360221	Photograph	06.411665	−074.70171	A
	Antioquia: Guadalupe, Muro de presa Porce III	https://www.inaturalist.org/observations/41131	Photograph	06.938611	−075.140219	A
	Boyacá: Puerto Romero, Las Quinchas	Rojas-Morales (2012); Calderon et al. (2018). https://www.gbif.org/occurrence/1912813376	ICN 054085; ICN-MHN-Rep7892	05.84305556	−074.3266667	A
	Caldas: Guarinocito, Purnio, La Dorada, Hacienda La Española	Flórez Jaramillo and Barona Cortés (2016)	Photograph	05.86666667	−074.75	A
	Caldas: La Victoria, Gravillera El Palmar, El Llano village	Rojas-Morales (2012)	MHUA-R 14785	05.32916667	−074.8491667	A
	Caldas: Samaná, Cañaveral village	Rojas-Morales (2012)	MHUA-R 14142	05.53694444	−074.9086111	A
	Caldas: Norcasia, Río Manso Natural Reserve, San Roque village	Rojas-Morales (2012)	Citation	05.66416667	−074.7858333	A
	Caldas: San Roque, Reserva Natural Privada Río Manso	Hoyos (2018). https://www.gbif.org/occurrence/1098671620	MPUJ_REPT 625	05.466667	−074.673889	A
	Caldas: Norcasia	https://www.inaturalist.org/observations/70025	Photograph	05.57393	−074.88861	A
	Cauca	AMNH (2015)	AMNH R-107943	02.61	−076.73	B
	Cesar: San Alberto, Miramar village	Moreno-Arias et al. (2009); Rojas-Morales (2012); Calderon et al. (2018). https://www.gbif.org/occurrence/1912815299	ICN 11489; ICN 054087	08.28888889	−073.4163889	A
	Chocó: Atrato, Yuto, Samurindó	Rengifo Mosquera and Pino-Mosquera (2018). https://www.gbif.org/occurrence/920161847	UTCH:COLZOOCH-H:0339	05.5875	−076.654167	A
	Chocó: Atrato, Yuto, San Martín de Purré	Rengifo Mosquera and Pino-Mosquera (2018). https://www.gbif.org/occurrence/920161849	UTCH:COLZOOCH-H:0299	05.64952	−076.57938	A
	Chocó: Medio Atrato, San Martín de Purré village	Rojas-Morales (2012)	Citation	05.68333333	−076.6666667	A
	Chocó: Choco	Espitia Barrera (2018). https://www.gbif.org/occurrence/1930060296	MLS-OFI 951	05.99	−076.94	B

Country	Locality	Reference	Voucher	Geographic coordinates		
				Latitude	Longitude	Source
Colombia	Chocó: Quibdó	Borja-Acosta (2017). https://www.gbif.org/occurrence/1801432080	IAvH-R-1796	05.71	−076.66	B
	Chocó: Río Sucio, Sautata	Borja-Acosta (2017). https://www.gbif.org/occurrence/1801432332	IAvH-R-2016	07.41	−077.06	B
	Chocó: Unguía, Peye	Rengifo Mosquera and Pino-Mosquera (2018). https://www.gbif.org/occurrence/1037379605	UTCH:COLZOOCH-H:1172	07.92043	−077.09677	A
	Chocó: Unión Panamericana, Animas, Salero	Rengifo Mosquera and Pino-Mosquera (2018). https://www.gbif.org/occurrence/1037379684	UTCH:COLZOOCH-H:1240	05.360278	−076.645833	A
	Córdoba: Tierralta, Palmira, La Plumilla village, Sector PNN Paramillo	Rojas-Morales (2012); Calderon et al. (2018). https://www.gbif.org/occurrence/1912815284	ICN 053929; ICN-MHN-Rep 11547	08.03305556	−076.1705556	A
	Magdalena: Santa Marta, Arimaca	https://www.inaturalist.org/observations/16216599	Photograph	11.11582	−074.124465	A
	Santander: El Carmen de Chucurí, Riosucio, finca de Santiago Hernández	Acosta-Galvis and Borja-Acosta (2018). https://www.gbif.org/occurrence/1881230076	IAvH-ACX566	06.577139	−073.573111	A
	Santander: Landá-zuri	Rojas-Morales (2012); Calderon et al. (2018). https://www.gbif.org/occurrence/1912807745	ICN 054086	06.35861111	−073.8994444	A
	Santander: Girón	https://www.inaturalist.org/observations/4151247	Photograph	07.080621	−073.365068	A
	Sucre: El Sereno Alto, Quebrada El Sereno, arriba de la estación	Borja-Acosta K (2017). https://www.gbif.org/occurrence/1801436159	IAvH-R-5486	09.542939	−075.340000	A
	Valle del Cauca: Buenaventura, Guamía village	Rojas-Morales (2012); Salinas and Valencia Aguilar (2018). https://www.gbif.org/occurrence/1078953951; Salinas and Valencia Aguilar (2018). https://www.gbif.org/occurrence/1078953953	UVC-13662, 13685	03.73166667	−076.9583333	A
	Valle del Cauca: Buenaventura, Bajo Anchicayá	Salinas and Valencia Aguilar (2018). https://www.gbif.org/occurrence/1078953944	UVC-9591	03.613741	−076.91095	A
	Valle del Cauca: Buenaventura, San Cipriano-Escalerete Forestal Reserve	Rojas-Morales (2012); Rojas-Morales et al. (2012)	Citation	03.83416667	−076.8883333	A
	Valle del Cauca: Río Calima, Campamento Chancos	Borja-Acosta (2017). https://www.gbif.org/occurrence/1801434523	IAvH-R-3995	03.89	−076.59	B
	Valle del Cauca: Buenaventura	https://www.inaturalist.org/observations/10527794	Photograph	03.569784	−076.877603	A
Venezuela	Zulia: Sierra de Perijá, Libertad, río Yasa, Kasmera indigenous village	Pons (1965)	MBLUZ R-182	09.94333333	−072.7491667	A
	Zulia: Sierra de Perijá, Río Tokuko, a ± 1 km al este de la comunidad de Ipika	Rojas-Runjaic and Infante-Rivero (2018)	MHNLS 20940	09.88166667	−072.8591667	A
	Zulia: Sierra de Perijá, Rosario de Perijá, Río Cogollo, Fundo Puerto Nuevo	Rojas-Runjaic and Infante-Rivero (2018)	MBLUZ R-486	10.3469444	−072.5161111	A
Ecuador	Esmeraldas: Reserva Tesoro Escondido. Alrededor de campamento, sendero "A", hasta cima de la montaña.	Pazmiño-Otamendi (2017)	QCAZR15012	00.4937599	−079.13608	A
	Esmeraldas: Zapallo Grande	Pazmiño-Otamendi (2017)	QCAZR 1595	00.7739939	−078.936	A
	Esmeraldas: Zona Baja de Reserva Ecológica Cotacachi Cayapas, Playa de Oro, Estero Pote y estero Angostura	Pazmiño-Otamendi (2017)	QCAZR 10703	00.8284639	−078.72201	A
	Manabí: A 15 km de Pedernales, en la vía a Jama	Pazmiño-Otamendi (2017)	QCAZR 5757	−00.078821	−080.02163	A
	Manabí: Reserva Ecológica Jama Coaque	Pazmiño-Otamendi (2017)	QCAZR 5889	−00.109405	−080.11753	A
	Manabí: Reserva Ecológica Jama Coaque	Pazmiño-Otamendi (2017)	QCAZR 4652	−00.090978	−080.14719	A
	Manabí: Río Cuaque, a 10 minutos de Perdenales, vía a Canoa	Pazmiño-Otamendi (2017)	QCAZR 8962	−00.02126	−080.06893	A